

# An Affordable New Home for a Family in Need

Warrior Home  
Student Design Team  
University of Waterloo  
Waterloo, ON, Canada  
info@warriorhome.ca



# Financial Feasibility and Affordability Narrative

U.S. Department of Energy  
Solar Decathlon 2020  
Build Competition

Kaikaiknong Crescent Development  
*Financial Feasibility and Affordability Narrative*  
BC\_WH\_JURYAFF  
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***The homes are very affordable - we are going above and beyond to make our units more energy efficient so it translates into savings in operation and maintenance costs for our tenants.***



**Shane Chegahno**

Housing Manager, Chippewas of Nawash

**Note:** All values in Canadian Dollars (\$CAD )  
unless otherwise specified



## Introduction

The Chippewas of Nawash Unceded First Nations community located on the Neyaashiinigmiing Reserve in Southwestern Ontario forms an integral part of the rich tapestry that is Canada's indigenous heritage. Like many Indigenous communities, however, access to adequate housing for all of its members is often a large challenge and one that is not sufficiently addressed by provincial and federal governments. With growing families and the return of community members wishing to live on their lands, the demand for good-quality, affordable housing that meets the needs of each Chippewas of Nawash community member kept rising. As a result, Warrior Home's entry for the Solar Decathlon Build Challenge aimed to address the housing crisis present in Canada's Indigenous communities through the design and construction of a sustainable home that also addresses the cultural and societal needs of the homeowner and community.

From 2018 to 2020, Warrior Home has worked closely with the Chippewas of Nawash to design and build a net-zero energy home that was made to accommodate the specific needs of the residents of the Neyaashiinigmiing Reserve. The team was able to partner with the Habitat for Humanity Grey Bruce to build a net-zero energy home in the Kaikaiknong Crescent development. After extensive consultation with community leaders, community members and the family that was set to receive the home, Warrior Home was able to develop an innovative and affordable design that integrates energy efficient technology, high-performance engineering systems as well as aesthetics, ergonomics, and Indigenous cultural integration. By December 2019, students and local volunteers were able to complete the construction of the Warrior Home design and a family of 5 was able to move in.

Warrior Home partnered with Habitat for Humanity Grey Bruce and the Chippewas of Nawash for this Build Challenge, making financial feasibility and affordability one of the team's major goals throughout the project. Design decisions were made with full consideration towards the target family and the community as a whole, to produce a high quality home within a tight budget.

What fueled the team to complete the design and help build the net-zero energy home were ultimately the wonderful people in the community, which include the housing authority, Chief and Band Council, the homeowners, a mother named Melissa and her four kids, and many others met throughout the process. Their unique stories and needs propelled the design for the home, which itself contributed towards the promotion of sustainable development within First Nations communities.

# Affordability

***There is a need for decent and affordable housing here and we're thrilled to be working with the Chippewas of Nawash Unceded First Nation***



**Deborah Haswell**

Board Chair, Habitat for Humanity Grey Bruce

The house was built in a small neighbourhood within the Indigenous reserve. Because of the team's partnership with Habitat for Humanity and the Chippewas of Nawash, the costs were minimized for both the band council and prospective homeowners. Habitat for Humanity's housing provision model revolves around the concept of "sweat equity", whereby homeowners will volunteer on the build site and then pay a monthly mortgage of 30% of their gross income; they are also exempt from a down payment on the home. However, it is important to note that Habitat for Humanity homes are sold at fair-market value. In Habitat for Humanity Grey Bruce's partnership with the Chippewas of Nawash, the homeowners and community members volunteer to build the homes with Habitat for Humanity and

the Chippewas of Nawash hold the mortgage. The Chippewas of Nawash then offer the homes to the homeowners through an innovative rent-to-own program where the homeowners pay a monthly rent of \$500 CAD per month, and after 20 years, the home is considered paid off. This rent-to-own arrangement is extremely affordable for the residents and costs substantially less than the average rent of a home in Ontario at \$2298 CAD. On top of this, the project is generously supported by the band council and the Canadian Federal Government.

***\$500 per month  
for 20 years***  
***Chippewas of Nawash  
Rent-to-Own Program***

This partnership with Habitat for Humanity was what allowed the home to be as affordable as possible. It also provided the homeowners with an added connection to their own home and allowed them to experience the many joys of traditional homeownership such as the opportunity to choose their own interior and exterior finishes. Additionally, the homeowner pays \$45/month in insurance, which is \$59 less than the provincial average.

***\$45 per month***  
***Insurance Bill***

***\$404***  
***Annual  
Electrical  
Bill Savings***

***50%***  
***Annual  
Water Bill  
Savings***

Monthly utility bills for the Warrior Home build are greatly decreased due to the use of a variety of energy- and resource-saving devices. For example, effective insulation, low-emissivity window coatings and a heat recovery ventilator were installed in order to reduce heat loss in the house. By effectively and efficiently storing heat, less energy is used for heat generation. Furthermore, solar panels were implemented to minimize the amount of energy the house requires from the grid, thus reducing energy cost for the family. To decrease water-resource costs, a hybrid-electric water heater tank was selected. By using this heat pump, water is heated by drawing heat from the surrounding air, and the family is able to save approximately \$404 CAD annually on their electrical bill. Additionally, the small square footage of the home decreases heating utility costs as it takes less energy to heat up the home. Air conditioning is disabled, which also decreases energy bills. Finally, low-flow fixtures were implemented to minimize water usage, which include faucets, toilets, and showerheads. These fixtures can potentially save the family up to 50% of their annual water bill. By implementing these technologies throughout the house, Warrior Home was able to reduce the overall utility cost for the homeowner.



Overall, the Warrior Home design cuts energy usage by 55% as compared to an average home of similar size, making this home very desirable.

**55%**

**Reduction in Energy Usage Compared to an Average 4-Bedroom House Before Net Metering**

The estimated costs of the competition prototype aligned well with market needs since working with the Chippewas of Nawash community and Habitat for Humanity Grey Bruce meant that the cost of the land and the cost of labour needed to both be minimal as compared to commercially built homes for sale outside the Neyaashiinigmiing Reserve. A significant portion of the funding to construct the entire subdivision comes from the Canadian Federal Government's Canadian Mortgage and Housing Corporation (CMHC).

**Community members were in serious need of housing. And we were in serious need of capital.**



**Greg Nadiwon**  
Chief, Chippewas of Nawash

The CMHC provided a grant to the Chippewas of Nawash and they were able to partner with Habitat for Humanity Grey Bruce to offset labour costs. Additionally, Warrior Home donated the \$25,000 USD prize money from the Solar Decathlon to cover the extra solar panel cost and other upgrades to the home which helped to further minimize any deviations from the overall project budget.

**\$25,000 USD**

**Warrior Home's Donation to the Chippewas of Nawash**

The Warrior Home house was built alongside 5 other homes in a new 17-house subdivision. The total cost of the six homes built simultaneously was approximately \$1,121,000 CAD. The Warrior Home and one other home were constructed as 4 bedroom houses while the remaining 4 homes were constructed as 3 bedroom houses which brings the estimated cost of the Warrior Home house to be \$220,500 CAD. This was very close to the team's initial projection of \$212,100 CAD.

**\$220,500**

**Total Cost of the House  
The Total Cost was Only 4% higher than our Initial Projections**

The market needs and expectations of the target family were also met. As discussed, the Chippewas of Nawash were able to insulate the family from most of the construction costs through a unique rent-to-own program in which the homeowner pays \$500

CAD in monthly rent and has the option to purchase the home for \$1 after 20 years. If the family is no longer occupying the home, they are unable to sell it in the same way as a regular home since only those who are registered with the Chippewas of Nawash are able to live on the reserve and it is possible for ownership to revert back to the Band Council if the home is unoccupied, which keeps the home within its intended market group.

Overall, Warrior Home's competition prototype closely matched both the Chippewas of Nawash's needs and expectations for construction costs and the homeowner's needs and expectations for living costs.




# Cost-Effectiveness

Considering the design of the house, which needs to be energy-efficient and effective during the cold winters, the house offers a good value for the inhabitants of this area. Elements that make the house unique, such as solar panels that produce electricity that can be sold to the grid, as well as water-efficient fixtures, significantly increase the value of the home while not increasing the overall cost substantially. The cost estimate indicated an increased \$40,000 CAD for the house compared to neighbouring houses with similar construction procedures.

Warrior Home has a unique target market - an Indigenous family - and a partnership with Habitat for Humanity. Using area statistics and information about nearby house sales, it was determined that the average cost of a house of this size in this location is approximately \$180,000 CAD. A cost estimate was done using RS Means and quotes from local professionals in the industry, with a total of \$212,103.31 CAD. This represents a slight increase from the baseline. However, it is anticipated that the technological improvements of the home will result in savings of \$3,300 CAD annually as compared to

the average home. This will be very beneficial to the occupants in the long run.



**\$3,300**  
**Estimated Overall Savings  
per Year Compared to an  
Average 4-Bedroom House**

## Cost Estimate


The team construction cost estimate from Deliverable 4 was approximately \$212,100 CAD. The as-built competition house cost \$220,500 CAD, which is only 4% more than what was estimated. Therefore, the construction cost estimate was very accurate and successfully reflected how much it would cost to build the home.

Most items that were included in the cost estimate were included in the as-built house. The cost for each item and the associated labour cost were estimated using both RS Means and direct quotes from industry professionals who work in the Grey Bruce area. The process of using accurate individual quotes for each part of the construction scope has proven to be a successful practice and has contributed to the accuracy of the cost estimate. The team's estimate of operational costs was fairly in-line with the actual operational costs of the

home, making the rental values easily affordable to the target market. The operational costs of the home are currently \$0.00 CAD for hydro-electric bills, exactly as planned by the team, and the home owner currently has credits on her account due to unused power generation, which can be put towards the costs of future months that see less energy production from the solar panels.

Internet costs approximately \$110.00 CAD per month; the cost of internet was not included in the preliminary cost analysis due to continuously changing rates and homeowner preferences. In terms of taxes and insurance, as planned, the homeowner does not have to pay any property taxes due to the home being a part of an Indigenous Reserve in Canada. As mentioned previously, insurance costs for the home are \$45.00 CAD per month. These values sum to approximately \$650.00

CAD per month for operational fees and are closely aligned with values the team had estimated in previous reports.



**\$220,500**  
**Total Cost of the House**  
**The Total Cost was Only  
4% higher than our Initial  
Projection of ~\$212,100**

**Cost Estimate Continued  
on Next Page →**

# Cost Estimate

**Electrical Power Generation**

14.0% (\$29,619.00)

**Exterior Improvements**

3.2% (\$6,781.00)

**Earth Work**

0.8% (\$1,655.68)

**Electronic Safety and Security**

0.8% (\$84.94)

**Electrical**

1.7% (\$3,588.45)

**Heating, Ventilating  
& Air Conditioning**

18.0% (\$38,265.21)

**Plumbing**

5.6% (\$11,829.65)

**Furnishings**

1.3% (\$2,842.00)

**Equipment**

1.8% (\$3,822.71)

**Specialities**

5.6% (\$11,825.45)

**Concrete**

6.3% (\$13,338.61)

**Metals**

2.8% (\$5,984.00)

**Wood, Plastics &  
Composites**

15.4% (\$32,618.00)

**Thermal & Moisture  
Protection**

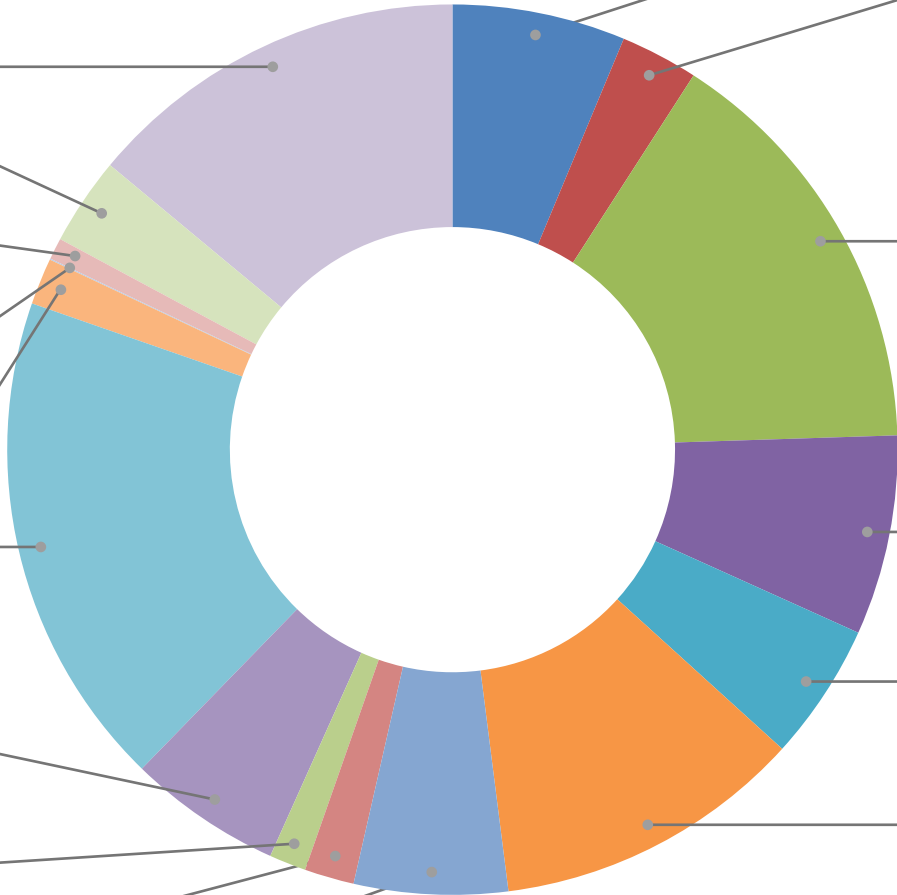
7.3% (\$15,389.28)

**Openings**

5.0% (\$10,568.61)

**Finishes**

11.3% (\$23,890.72)



**\$212,103.31**  
**Total Cost Estimate**  
**See Appendix A for Detailed  
Cost Estimate**

# Conclusion

In summary, the house designed by the Warrior Home team effectively met the expectations of the target market and the cost estimates were very accurate. The multi-generational Indigenous home that was constructed is optimized for comfort to the occupants while remaining within an acceptable price range. Monthly utility bills for the Warrior Home build were greatly decreased as a result of the use of a variety of energy- and resource-saving devices, ultimately cutting energy usage by 55%. The accurate cost estimates and reasonable cost effective decisions allowed a monthly rent of \$500 CAD to be feasible for the Chippewas of Nawash. Warrior Home has presented a very feasible and affordable home that is suitable to the team's target market, and the team's financial considerations greatly contributed to the increased satisfaction of the family.

***I feel safe knowing that the home is affordable enough for me to stay home with my child taking care of her. So to know that that stability is there and that that's going to be my daughter's forever home... that means more than anything.***



**Melissa Millette**  
Homeowner



***Designed and Built  
for an Affordable and  
Sustainable Future***



## **Appendix A: Detailed Cost Estimate**

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<b>Brief Description</b>	<b>Detailed Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Rate</b>	<b>Total</b>
<b><i>DIVISION 03 - CONCRETE</i></b>					
ICF	ICF insulating forms left in place, straight blocks or panels, molded, walls up to 4' high, 12" core wall, includes layout, exludes rebar, embedments, bucks for openings, scaffolding, wall bracing, concrete, and concrete placing	488.25	ft <sup>2</sup>	\$8.29	\$4,047.59
Structural Concrete	Structural concrete, ready mix, heavyweight, 4000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments	28.64	yd <sup>3</sup>	\$220.78	\$6,323.14
Concrete Slab Placement	Structural concrete, placing, slab on grade, direct chute, up to 6" thick, includes leveling (strike off) & consolidation, excludes material	19.62	yd <sup>3</sup>	\$16.63	\$326.28
Reinforced Concrete	Crawl space floor and porch	416	ft <sup>3</sup>	\$6.35	\$2,641.60
<b><i>DIVISION 05 - METALS</i></b>					
Steel Beams	W8x31 (im.) 2 beams in crawl space	94	ft <sup>2</sup>	\$36.00	\$5,384.00
Steel Posts	HSS 3x3x.188. (incl \$500 transport and installation costs)	2	Each	\$50.00	\$600.00
<b><i>DIVISION 06 - WOOD, PLASTICS AND COMPOSITES</i></b>					
Plywood	Subfloor. 5/8 Plywood Sheets	1592	ft <sup>2</sup>	\$1.09	\$1,740.26
Floor Joists	9.5" deep engineered I-Joists	39	Each	\$35.00	\$1,365.00
Sheathing	Sheathing, plywood on roof, CDX, 1/2" thick	1892	ft <sup>2</sup>	\$1.52	\$2,875.84
Rafters (Truss)	Roof trusses, common wood, 2" x 4", metal plate connected, 24" OC, 4/12 slope, 1' overhang, 20' span	26	Each	\$143.00	\$3,718.00
Furring	Furring, wood, on walls, on wood, 1" x 3"	100	lft	\$1.29	\$129.00
Sheathing	Sheathing, oriented strand board, 7/16" thick, on walls	1500	ft <sup>2</sup>	\$1.31	\$1,965.00
Studs	Wood framing, partitions, standard & better lumber, 2" x 6" studs, 16" OC, 8' high, includes single bottom plate and double top plate, excludes waste	197	lft	\$17.14	\$3,376.58
EPS Insulation	Structural insulated panel, 7/16" OSB both faces, EPS insulation, 5-5/8" thick	1592	ft <sup>2</sup>	\$7.68	\$12,226.56
Plywood Paneling	Plywood paneling, prefinished, with vertical grooves, birch faced, custom, 4' x 8' x 1/4" thick	1592	ft <sup>2</sup>	\$3.28	\$5,221.76
<b><i>DIVISION 07 - THERMAL AND MOISTURE</i></b>					
Damp Proof Membrane	Filter Fabric	860	ft <sup>2</sup>	\$0.40	\$344.00
Drainage Pad	Dimple Mat	860	ft <sup>2</sup>	\$1.20	\$1,032.00

<b>Brief Description</b>	<b>Detailed Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Rate</b>	<b>Total</b>
Asphalt Roof Shingles	Asphalt shingles, self adhering polyethylene and rubberized asphalt underlayment	24	Sq.	\$112.98	\$2,711.52
Insulation	Blanket insulation, for walls or ceilings, mineral wool batts, 5-1/2" thick, R23	1500	ft²	\$1.84	\$2,760.00
Air and Vapour Barrier	Vapor retarders, building paper, polyethylene vapor barrier, standard, 6 mil (.006" thick), 9' x 400' roll	4984	ft²	\$0.15	\$747.60
Blown-in Cellulose	Blown-in insulation, ceilings, with open access, cellulose, 10-7/8" thick, R38	1592	ft²	\$1.73	\$2,754.16
Cladding	Vinyl siding, clapboard profile, woodgrain texture, .048 thick, double 4"	1500	ft²	\$3.05	\$4,575.00
Tyvek / Housewrap	Weather barriers, building paper, housewrap, exterior, spun bonded polypropylene, large roll	1500	ft²	\$0.31	\$465.00
<b><i>DIVISION 08 - OPENINGS</i></b>					
Closet Door	24 in. x 80 in. Louver Pine White Interior Closet Bi-fold Door (incl. installation cost of \$150.00)	10	Each	\$96.00	\$1,110.00
Interior Doors	Masonite 32-inch x 80-inch x 1 3/8-inch Molded 6 Panel Interior Door (incl. installation cost of \$1050.00)	7	Each	\$47.37	\$1,381.59
Windows	Windows, triple-pane, vinyl single hung	81.5	ft²	\$90.00	\$7,335.00
Metal Doors	Doors, residential, steel, prehung, insulated, exterior, embossed, half glass, 3'-0" x 6'-8"	2	Each	\$371.01	\$742.02
<b><i>DIVISION 09 - FINISHES</i></b>					
Laminate (Hardwood Look)	SMARTCORE Rustic Hickory 5.5-mm Luxury Vinyl Plank Flooring (5.0-in W x 48.03-in L) Includes installation cost of \$1400.00)	1	Each	\$2,765.00	\$4,165.00
Indoor Paint	5 gal. #720E-2 Light French Gray Flat Low Odor Interior Paint and Primer in One (incl. labour cost of \$800.00)	4	Each	\$216.00	\$1,664.00
Kitchen Backsplash	Smart Tiles Metro Grigio Grey 11.56-inch W x 8.38-inch H Peel and Stick Decorative Wall Tile (installation cost is included in shower tile installation cost)	20	Each	\$5.98	\$119.60
Tile	Enigma Carrara Nevoso 12-inch x 24-inch HD Pressed Matte Porcelain Tile (15.5 sq.ft. / case) (Installation cost is included in laminate flooring installation cost)	27	Each	\$26.20	\$707.40
Shower Tile	MAAX Utile Carrara Marble Shower Wall Surround Back Panel (incl. \$600.00 installation cost)	2	Each	\$679.00	\$1,958.00
Trim	Ornamental Mouldings White Hardwood Colonial Trim Moulding 1/4 x 13/32 - Sold Per 8 Foot Piece (incl. \$3,397.50 installation cost)	95	Each	\$5.41	\$3,911.45
Kitchen Countertop	Formica Laminate Cararra Bianco 96-inch x 48-inch Laminate Sheet in Etchings Finish (incl. installation cost of \$240.00)	2	Each	\$104.00	\$448.00

<b>Brief Description</b>	<b>Detailed Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Rate</b>	<b>Total</b>
Drywall (on walls)	Gypsum wallboard, on walls, standard, taped & finished (level 4 finish), 1/2" thick	4489.46	ft²	\$1.39	\$6,240.35
Drywall (on ceilings)	Gypsum wallboard, on ceilings, taped & finished, standard, 1/2" thick	1592	ft²	\$1.59	\$2,531.28
Drywall (on walls, mold resistant)	Gypsum wallboard, on walls, mold resistant, taped & finished, 1/2" thick	1358	ft²	\$1.58	\$2,145.64
<b><i>DIVISION 10 - SPECIALTIES</i></b>					
Handrail for Visual Impairment	Custom Handrails (Incl. installation cost of \$3,911.45)	125	Each	\$63.18	\$11,809.45
Towel Rack	KUNGSFORS Rail IKEA	4	Each	\$4.00	\$16.00
Toilet Paper Holder	BALUNGEN Toilet Roll Holder IKEA (incl. installation cost of \$25.00)	2	Each	\$26.99	\$78.98
<b><i>DIVISION 11 - EQUIPMENT</i></b>					
Refrigerator / Freezer	Frigidaire FFTR1814TS (Incl. installation cost of \$300.00)	1	Each	\$1,096.06	\$1,096.06
Microwave	Panasonic NNSD965S	1	Each	\$266.09	\$266.09
Oven + Stove	Frigidaire CFEF3016VS (Incl. installation cost of \$100.00)	1	Each	\$844.00	\$844.00
Clothes Washer and Dryer	GE GTW485BMMWS & GTD45EBMKWS (Incl. installation cost of \$200.00)	1	Each	\$1,198.56	\$1,198.56
Range Hood (Oven Fan)	30-inch 340 CFM Range Hood in Stainless Steel (incl. \$50.00 labour)	1	Each	\$368.00	\$418.00
<b><i>DIVISION 12 - FURNISHINGS</i></b>					
Laundry Room Cabinet	SEKTION Wall cabinet frame, white (incl. installation cost of \$125.00)	2	Each	\$23.00	\$171.00
Base Kitchen Cabinet	Eurostyle Base Cabinet Florence 36 in - Ready to Assemble (incl. installation cost of \$125.00)	3	Each	\$294.00	\$1,007.00
Corner Kitchen Cabinet	Eurostyle Base Cabinet Florence 36 in - Ready to Assemble (incl. installation cost of \$125.00)	1	Each	\$294.00	\$419.00
Wall Kitchen Cabinet	Eurostyle Wall Cabinet Florence 30x30x12,5 - Ready to Assemble (incl. installation cost of \$125.00)	5	Each	\$224.00	\$1,245.00
<b><i>DIVISION 22 - PLUMBING</i></b>					
Laundry Sink	Technoform Laundry Tub Granite Finish (Incl. Installation cost of \$100.00)	1	Each	\$59.99	\$159.99
Kitchen Sink	Kindred Double Bowl Kitchen Sink with Spillway (Incl. installation cost of \$200.00)	1	Each	\$149.00	\$249.00
Kitchen and Laundry Faucet	Danze 1-Handle Metal Lever Kitchen Faucet (Incl. Installation cost of Total \$200.00)	2	Each	\$23.99	\$247.98

<b>Brief Description</b>	<b>Detailed Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Rate</b>	<b>Total</b>
Toilet	American Standard Reliant 4.8 LPF Round Front Toilet in White (incl. installation cost of \$300.00)	2	Each	\$139.00	\$578.00
Shower Head	Waterpik PowerSpray 6-Spray Fixed Mount Shower Head in Chrome (incl. installation cost of \$50)	2	Each	\$33.24	\$116.48
Bathtub	American Standard Cadet 5 ft. Enamel Steel Bathtub with Left-Hand Outlet in White (incl. installation cost of \$500)	1	Each	\$209.00	\$709.00
Bathroom Sink	American Standard Colony Basin (incl. installation cost of \$200.00)	2	Each	\$79.99	\$359.98
Bathroom Sink Faucet	Danze Renovate 2-Handle Lavatory Faucet, Chrome (incl. installation cost of \$150.00)	2	Each	\$39.99	\$229.98
Shower	MAAX Davana 38-inch x 38-inch x 78 3/4-inch Neo-Angled Frameless Shower Stall in Brushed Nickel (incl. installation cost of \$1500.00)	1	Each	\$1,538.00	\$3,038.00
PEX Pipe	PEX Pipe (1/2") (incl \$960.00 Installation cost)	468	Each	\$2.69	\$2,218.92
PVC Sanitary drain piping (4")	IPEX Ecolotube (incl. \$480.00 installation cost)	103	Each	\$1.70	\$655.10
Flow Monitor	incl. \$15.00 installation cost	1	Each	\$595.00	\$610.00
Tankless Water Heater	Rheem RTEX-36 (incl. \$240.00 installation cost)	1	Each	\$964.00	\$1,204.00
Apollo PEX Manifold System	Installation included with PEX Pipe.	1	Each	\$343.22	\$343.22
Drain Water Heat Recovery	PowerPipe R4-36 (incl. \$240.00 installation cost)	1	Each	\$730.00	\$970.00
Perforated Drain Pipe	4" "Big O" c/w Filter sock	1	Each	\$140.00	\$140.00
<b><i>DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING</i></b>					
Heat Pump Outdoor Unit	Includes labour and supplies (refrigerant lines, thermostat). Requires 2 days to install	1	Each	\$7,900.00	\$7,900.00
Heat Pump Indoor Unit / Air Handler	3 Ton, Single Piece Air Handler, Multi-Position Variable Speed ECM Motor, Communications Ready, 17.5" Cabinet Width, 208/230-1-60, Flex - Coils. Includes labour and supplies. Installation time is included with the Outdoor Unit	1	Each	\$3,100.00	\$3,100.00
Electric Heat Kit	20 kW 208/230-1-60 Electric Heat Kit w/ Circuit Breaker and Jumper Bar	1	Each	\$488.34	\$488.34
Thermostatic Expansion Valve	KIT,TXV,R-410A,3/4 INCH CHATLEFF CO	1	Each	\$181.88	\$181.88
HRV - Unit Only	LIFEBREATH RNC SERIES – MODEL RNC 155 (HRV)	1	Each	\$945.00	\$945.00
Ductwork	Incl. materials and 5 days of labour.	422	lft	\$60.00	\$25,320.00



<b>Brief Description</b>	<b>Detailed Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Rate</b>	<b>Total</b>
Control for HVAC	Google Nest Wi-Fi Smart Learning Thermostat 3rd Generation	1	Each	\$329.99	\$329.99
<b><i>DIVISION 26 - ELECTRICAL</i></b>					
Round Light	Canarm Ltd- 4 inch LED Brushed Nickel Recessed Round Downlight - ENERGY STAR	12	Each	\$27.98	\$335.76
Dimmable LED Fixture	Strak LED - LED 16" FlushMount Fixture 16W = 160W Brush Nickel 1600LM 3000K Dimmable ES - ENERGY STAR	4	Each	\$34.99	\$139.96
Bedroom / Bathroom Ceiling Light	Hampton Bay - 10.75-inch Brushed Nickel LED Flushmount Ceiling Light with Frosted Glass Shade - ENERGY STAR	6	Each	\$14.98	\$89.88
Vanity (bulbs excluded)	Globe Electric 5-Piece Estorial Brushed Steel All-In-One Bath Set with Vanity Light (no bulbs included)	1	Each	\$79.97	\$79.97
Vanity Bulbs	Philips LED 9.5W = 60W A-Line (A19) Warm Glow (2700K- 2200K) - Case of 4 Bulbs	1	Each	\$35.88	\$35.88
Light Switches	Switch devices, residential, single pole, ivory, type NM (Romex) cable, 20', 15 amp, incl box & cover plate	10	Each	\$34.44	\$344.40
15A Electrical Outlet	Receptacle devices, residential, duplex outlet, ivory, type NM cable, 20', 15 amp, incl box and cover plate	31	Each	\$29.43	\$1,314.40
GFC1 Electrical Outlet	Material and Installation Cost	9	Each	\$125.00	\$1,125.00
20A Electrical Outlet	Receptacle devices, residential, duplex outlet, ivory, w/#12/2, type NM cable, 20, 20 amp, incl box and cover plate	2	Each	\$45.28	\$123.20
<b><i>DIVISION 28 - ELECTRONIC SAFETY AND SECURITY</i></b>					
Smoke Detectors	Kidde Pro Series 120V Hardwire Smoke Alarm with Hush Button and Battery Backup	5	Each	\$29.97	\$149.85
CO Detectors	Kidde Worry Free Living Area 10 Yr Digital CO Alarm - 10 Yr sealed Battery	2	Each	\$54.97	\$109.94
<b><i>DIVISION 31 - EARTHWORK</i></b>					
Gravel Fill	Fill, gravel fill, compacted, under floor slabs, 6" deep	1592	ft²	\$1.04	\$1,655.68
<b><i>DIVISION 32 - EXTERIOR IMPROVEMENTS</i></b>					
Vegetation	Basil	1	Each	\$7.00	\$7.00
Vegetation	Bearberry	12	Each	\$7.00	\$84.00
Vegetation	Big Bluestem	7	Each	\$7.00	\$49.00
Vegetation	Black Eyed Susan	6	Each	\$7.00	\$42.00

<b>Brief Description</b>	<b>Detailed Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Rate</b>	<b>Total</b>
Vegetation	Black Hill Spruce - Picea Glauca	1	Each	\$50.00	\$50.00
Vegetation	Bur Oak - Quercus Macrocarpa	1	Each	\$50.00	\$50.00
Vegetation	Cherry Tomatos	2	Each	\$7.00	\$14.00
Vegetation	Christmas Fern	4	Each	\$7.00	\$28.00
Vegetation	Common Elderberry	1	Each	\$15.00	\$15.00
Vegetation	Common Juniper	3	Each	\$15.00	\$45.00
Vegetation	Cone flowers	6	Each	\$7.00	\$42.00
Vegetation	Creeping Phlox	14	Each	\$7.00	\$98.00
Vegetation	Daisy Fleabane	3	Each	\$7.00	\$21.00
Vegetation	Eastern Ninebark	1	Each	\$15.00	\$15.00
Vegetation	Egg plant	1	Each	\$7.00	\$7.00
Vegetation	Feather Reed Grass	9	Each	\$7.00	\$63.00
Vegetation	Forget-me-not	11	Each	\$7.00	\$77.00
Vegetation	Green beans	1	Each	\$7.00	\$7.00
Vegetation	Green onions	1	Each	\$7.00	\$7.00
Vegetation	Honey Crisp Apple Tree	2	Each	\$50.00	\$100.00
Vegetation	Hydranga	7	Each	\$15.00	\$105.00
Vegetation	Little Bluestem	6	Each	\$7.00	\$42.00
Vegetation	Lowbush Blueberry	2	Each	\$7.00	\$14.00
Vegetation	Meadow Rue	2	Each	\$7.00	\$14.00
Vegetation	Milkweed (Butterfly)	1	Each	\$7.00	\$7.00
Vegetation	Milkweed (Common)	1	Each	\$7.00	\$7.00
Vegetation	Mint	1	Each	\$7.00	\$7.00
Vegetation	Nannyberry	1	Each	\$7.00	\$7.00
Vegetation	Narrow-leaved Vervain	2	Each	\$7.00	\$14.00
Vegetation	New England Aster	4	Each	\$7.00	\$28.00
Vegetation	Oxeye Sunflower	4	Each	\$7.00	\$28.00
Vegetation	Parsley	1	Each	\$7.00	\$7.00
Vegetation	Periwinkle	6	Each	\$7.00	\$42.00
Vegetation	Prairie Dropseed	2	Each	\$7.00	\$14.00

<b>Brief Description</b>	<b>Detailed Description</b>	<b>Qty.</b>	<b>Unit</b>	<b>Unit Rate</b>	<b>Total</b>
Vegetation	Red-osier dogwood	6	Each	\$15.00	\$90.00
Vegetation	Saskatoon Berry	1	Each	\$15.00	\$15.00
Vegetation	Showy trick-trefoil	2	Each	\$7.00	\$14.00
Vegetation	Spotted Joe-pye weed	3	Each	\$7.00	\$21.00
Vegetation	Strawberries	1	Each	\$7.00	\$7.00
Vegetation	Sugar Maple - Acer Saccharum	1	Each	\$50.00	\$50.00
Vegetation	Swamp Milkweed	5	Each	\$7.00	\$35.00
Vegetation	Thyme	1	Each	\$7.00	\$7.00
Vegetation	White Cedar - Thuja Occidentalis	1	Each	\$50.00	\$50.00
Vegetation	Wild Columbine	4	Each	\$7.00	\$28.00
Vegetation	Wild Lupine	4	Each	\$7.00	\$28.00
Vegetation	Canadian Plum (Tree)	1	Each	\$50.00	\$50.00
Vegetation	Woodland Sunflower	1	Each	\$7.00	\$7.00
Hardscape	Low Wooden Deck	1	Each	\$1,500.00	\$1,500.00
Hardscape	Gravel Pathway	1157	ft²	\$2.00	\$2,314.00
Hardscape	Stone Patio	176	ft²	\$8.00	\$1,408.00
<b><i>DIVISION 48 - ELECTRICAL POWER</i></b>					
Solar Installation	Entire System (Panels, Inverter, Labour, etc).	1	Each	\$28,819.00	\$28,819.00
Hydro One Fee	Hydro One's fee for Net Metering Implementation	1	Each	\$800.00	\$800.00
				<b>TOTAL</b>	<b>\$212,103.31</b>

**U.S. DEPARTMENT OF ENERGY  
SOLAR DECATHLON 2020  
BUILD COMPETITION**

**Kaikaiknong Crescent Development**  
*Financial Feasibility and Affordability Narrative*  
**BC\_WH\_JURYAFF**  
*Submission Date: 03/02/21*

**Warrior Home**  
**Student Design Team**  
*University of Waterloo*  
*Waterloo, ON, Canada*  
*info@warriorhome.ca*

